CLAIMS

What is claimed is:

1. A method of placing a component having leads to a substrate comprising:

providing a fiducial marker on a component to be placed on a substrate that distinguishes the alignment of leads on the component;

detecting the alignment of the fiducial marker on the component;

comparing the detected fiducial alignment with a predetermined fiducial alignment corresponding to a predetermined lead alignment; and,

placing the component to a substrate when the detected fiducial alignment corresponds to the predetermined fiducial alignment.

2. The method of claim 1, wherein providing a fiducial marker includes providing a physically asymmetric marker.

3. The method of claim 2, wherein detecting the alignment further comprises:

providing a nest having an asymmetrically shaped recess corresponding to the physically asymmetric marker on the component;

bringing the component and the nest into contact; and,

detecting whether the physically asymmetric marker on said component mates with the asymmetrically shaped recess.

4. The method of claim 3, wherein bringing the components includes placing the component in the nest.

5. The method of claim 3, wherein detecting the alignment includes providing a sensor within the recess to distinguish when the leads or the component are in the predetermined alignment.

6. The method of claim 5, wherein providing a sensor includes providing a vacuum sensor.

7. The method of claim 5, wherein providing a sensor includes providing a contact sensor.

8. The method of claim 3, wherein detecting the alignment includes providing a receiver to detect whether the fiducial marker mates with the asymmetrically shaped recess.

9. The method of claim 8, wherein:

detecting the alignment further includes positioning an emitter to direct radiation toward the recess in the nest; and,

providing a receiver further includes providing a receiver in a position to receive emitted radiation indicative of whether the fiducial marker is mated with the asymmetrical shaped recess.

10. The method of claim 1, wherein providing a fiducial marker includes providing a superficial asymmetric marker.

11. The method of claim 1, wherein providing a fiducial marker further comprises providing multiple fiducial markers.

12. The method of claim 1, wherein detecting the alignment further comprises detecting the fiducial marker visually.

13. A method of attaching a component to a substrate comprising:

providing a fiducial marker on a component to be placed on a substrate that distinguishes the alignment of leads on the component;

detecting the alignment of the fiducial marker on the component;

comparing the detected alignment with a predetermined fiducial alignment to determine an alignment offset;

adjusting the position of the component relative to the substrate to eliminate the alignment offset; and,

attaching the component to the substrate.

14. A method of verifying a predetermined lead alignment of a component comprising:

providing a physical asymmetry on a component to be placed on a substrate that distinguishes the alignment of leads on the component;

providing a nest containing a recess that corresponds to and mates with the physical asymmetry on the component when the leads on the component have a predetermined alignment;

placing the component in the nest; and,

detecting whether the physical asymmetry has mated with the recess to verify the lead alignment.

15. A method of picking a component having a predetermined lead alignment comprising:

providing a fiducial marker on a component that distinguishes the alignment of leads on the component;

detecting the alignment of the fiducial marker;

comparing the detected alignment with a predetermined fiducial alignment to determine an alignment offset necessary to pick the component in accordance with the predetermined lead alignment; and,

picking the component in accordance with the alignment offset.

16. The method of claim 15, wherein picking the component comprises:

positioning a pick head in accordance with the alignment offset; and,

picking the component using the pick head.

17. The method of claim 15, wherein picking the component comprises:

picking the component using a pick head; and,

orienting the pick head and component in accordance with the alignment offset.

18 The method of claim 15, wherein:

providing a fiducial marker further comprises providing a superficial fiducial marker; and,

detecting the alignment further comprises detecting visually the superficial fiducial marker.

19. The method of claim 15, wherein providing a fiducial marker includes providing a physically asymmetric fiducial marker.

20 The method of claim 15, wherein picking the component further comprises:

moving a pick head proximate to the component; and,

applying a negative pressure through the pick head sufficient to hold the component against the pick head.

21. A component alignment detection apparatus comprising:

a nest including a nest surface containing an asymmetric recess; and,

a detector positioned to detect an alignment of a component placed in said recess, compare said detected alignment with a known alignment, and provide an alignment signal indicative of whether said detected alignment corresponds with said known alignment.

22. An apparatus for moving components comprising:

a pick and place machine including a movable pick head configured to pick components and having access to an asymmetric recess in a nest;

a component feed source configured to supply components to said recess; and,

a detector positioned to detect an alignment of a component placed in said recess, compare said detected alignment with a known alignment, and provide an alignment signal indicative of whether said detected alignment corresponds with said known alignment.

23. The apparatus of claim 22, wherein said detector is connected to control said pick and place machine in response to said comparison.

24. The apparatus of claim 22, wherein said detector is further positioned in a plane substantially parallel and proximate to a surface of said nest containing said recess.

25. The apparatus of claim 22, wherein said pick and place machine comprises a machine selected from the group consisting of surface mount placement machines, die attach machines, tape and reel production machines, and wire bond machines.

26. The apparatus of claim 22, wherein said recess corresponds to a shape of a component being picked using said pick head.

27. The apparatus of claim 22, wherein said detector comprises:

a nest containing a physically asymmetric recess; and

a sensor positioned with said recess.

28. The apparatus of claim 27, wherein said sensor is selected from the group consisting of pressure sensors, contact sensors, electrical sensors, mechanical sensors, thermal sensors and other environmental sensors.

29. The apparatus of claim 27, wherein said sensor comprises a vacuum sensor.

30. An apparatus for moving components comprising:

a pick and place machine including a controller connected to a movable pick head and a component feed source, said pick head having access to said component feed source; and,

a detector comprising a receiver directed toward said feed source to detect an alignment of a component, said controller being connected to said receiver and configured to compare the detected component alignment with a known component alignment.

31. The apparatus of claim 30, wherein said component feed source comprises a continuous serial track component feed source.

32. The apparatus of claim 31, wherein said continuous serial track component feed source further comprises a plurality of component trays serially disposed along said track.

33. The apparatus of claim 32, wherein said plurality of component trays contains a recess having an asymmetric shape.

34. The apparatus of claim 30, wherein said feed source further comprises a plurality of serial feed sources.

35. The apparatus of claim 34, wherein said detector further comprises a plurality of receivers and each of said plurality of serial feed sources has at least one corresponding receiver positioned to detect an alignment of a component in said serial feed source.

36. The apparatus of claim 30, wherein said detector and said pick head are distinct members.

37. The apparatus of claim 30, wherein said detector is ~~stationary with respect to said pick head.~~

38. An apparatus for moving components comprising:

a pick and place machine including,

a pick station connected to a component feed source,

a first pick head having access to said pick station and a component transfer area,

a second pick head having access to said component transfer area and a component mounting position,

a detector positioned to detect an alignment of a component in said component transfer area, and

a controller connected to said feed source, said first pick head, said second pick head, and said detector and said controller being configured to compare the detected component alignment with a known component alignment and control said feed source, said first pick head, and said second pick head in response to said comparison.

39. The apparatus of claim 38 wherein said detector comprises:

a nest that is accessible by said first and second pick heads; and,

a receiver positioned to detect an alignment of a component placed in said nest and compare said detected alignment with a known alignment.

40. The apparatus of claim 39 wherein:

said nest includes a nest surface containing an asymmetrically shaped recess;

said detector further comprises an emitter positioned to direct radiation toward said recess in a generally parallel direction adjacent to said nest surface; and,

said receiver is positioned on a side of said recess opposite to said emitter to receive radiation from said emitter directed toward to said recess.

41. An apparatus for detecting alignment of a component having an asymmetric shape, comprising:

a nest including a nest surface containing an asymmetric recess corresponding to the shape of said component; and,

a detector positioned to detect whether said component is completely received in said recess and provide an alignment signal indicative of whether said component was completely received.

42. An apparatus for moving components, comprising:

a nest including a nest surface containing an asymmetric recess corresponding to asymmetrically shaped components;

a pick and place machine including a movable pick head configured to pick components from said asymmetric recess in a nest;

a component feed source configured to serially supply said components to said recess; and,

a detector positioned to detect whether said component supplied to said recess is completely received in said recess and provide an alignment signal indicative of whether said component was completely received.

43. The apparatus of claim 42, wherein said detector is connected to control said pick and place machine in response to whether said component is detected as being completely received in said recess.

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